Confidence Interval Type	Formula	Conditions	Calculator Test
Proportions	$\hat{p} \pm (z^*)\sqrt{\dfrac{\hat{p}(1-\hat{p})}{n}}$	1. The sample is a simple random sample. 2. The population is large relative to the sample $10n < N$ 3. $np \geq 10$ $n(1-p) \geq 10$	1-PropZInterval
Means (σ known)	$\bar{x} \pm (z^*)\left(\dfrac{\sigma}{\sqrt{n}}\right)$ *for sample size*	1. The sample is a simple random sample. 2. The population is normal or $n \geq 30$ 3. The population standard deviation (σ) is known.	ZInterval
Means (σ unknown)	$\bar{x} \pm (t^*)\left(\dfrac{s}{\sqrt{n}}\right)$	1. The sample is a simple random sample. 2. The population is approximately normal (graphical support required) or $n \geq 40$ 3. The population standard deviation (σ) is unknown.	TInterval

Multiple Choice Practice:

1. A researcher is interested in determining the mean energy consumption of a new compact florescent light bulb. She takes a random sample of 41 bulbs and determines that the mean consumption is 1.3 watts per hour with a standard deviation of 0.7. When constructing a 97% confidence interval, which would be the most appropriate value of the critical value?

(a) 1.936   (b) 2.072   (c) 2.250   (d) 2.704   (e) 2.807

2. A polling company is trying to estimate the percentage of adults that consider themselves happy. A confidence interval based on a sample size of 360 has a larger than desired margin of error. The company wants to conduct another poll and obtain another confidence interval of the same level but reduce the error to one-third the size of the original sample. How many adults should they now interview?

(a) 40   (b) 180   (c) 720   (d) 1080   (e) 3240

$$\frac{ME}{3} = \frac{t^* \frac{s}{\sqrt{n}}}{3} \rightarrow \frac{t^* s}{3\sqrt{n}} = \frac{t^* s}{\sqrt{9n}}$$

3. A biologist has taken a random sample of specific type fish from a large lake. A 95 percent confidence interval was calculated to be 6.8 ± 1.2 pounds. Which of the following is true?

(a) 95 percent of all the fish in the lake weigh between 5.6 and 8 pounds.
(b) In repeated sampling, 95 percent of the sample proportions will fall within 5.6 and 8 pounds.
(c) In repeated sampling, 95% of the time the true population mean of fish weights will be equal to 6.8 pounds.
(d) In repeated sampling, 95% of the time the true population mean of fish weight will be captured in the constructed interval.
(e) We are 95 percent confident that all the fish weigh less than 8 pounds in this lake.

4. A research and development engineer is preparing a report for the board of directors on the battery life of a new cell phone they have produced. At a 95% confidence level, he has found that the mean battery life is 3.2 ± 1.0 days. He wants to adjust his findings so the margin of error is as small as possible. Which of the following will produce the smallest margin of error?

(a) Increase the confidence level to 100%. This will assure that there is no margin of error.
(b) Increase the confidence level to 99%.
(c) Decrease the confidence level to 90%.
(d) Take a new sample from the population using the exact same sample size.
(e) Take a new sample from the population using a smaller sample size.

5. The board of directors at a city zoo is considering using commercial fast food restaurants in their zoo rather than the current eateries. They are concerned that major donors to the zoo will not approve of the proposed change. Of the 280 major donors to the zoo, a random sample of 90 is asked, "Do you support the zoo's decision to use commercial fast food restaurants in the zoo?" 50 of the donors said no, 38 said yes, and 2 had no opinion on the matter. A large sample z-interval was constructed from these data to estimate the proportion of the major donors who support using commercial fast food restaurants in the zoo. Which of the following statements is correct for this confidence interval?

(a) This confidence interval is valid because a sample size of more than 30 was used.
(b) This confidence interval is valid because no conditions are required for constructing a large sample confidence interval for proportions.
(c) This confidence interval is not valid because the sample size is too large compared to the population size.
(d) The confidence interval is not valid because the quantity $n\hat{p}$ is too small.
(e) This confidence interval is not valid because "no opinion" was allowed as a response.

6. How large of a random sample is required to insure that the margin of error is 0.08 when estimating the proportion of college professors that read science fiction novels with 95% confidence?

(a) 600   (b) 300   (c) 150   (d) 75   (e) 25

7. A quality control specialist at a plate glass factory must estimate the mean clarity rating of a new batch of glass sheets being produced using a sample of 18 sheets of glass. The actual distribution of this batch is unknown, but preliminary investigations show that a normal approximation is reasonable. The specialist decides to use a t-distribution rather than a z-distribution because

(a) The z-distibution is not appropriate because the sample size is too small.
(b) The sample size large compared to the population size.
(c) The data comes from only one batch.
(d) The variability of the batch is unknown.
(e) The t-distribution results in a narrower confidence interval.

8. A random sample of 100 visitors to a popular theme park spent an average of $142 on the trip with a standard deviation of $47.5. Which of the following would the 98% confidence interval for the mean money spent by all visitors to this theme park?

(a) ($130.77, $153.23)
(b) ($132.57, $151.43)
(c) ($132.69, $151.31)
(d) ($140.88, $143.12)
(e) ($95.45, $188.55)

953   1003

9. A 98 percent confidence interval for the mean of a large population is found to be 978 ± 25. Which of the folowing is true?

(a) 98 percent of all observations in the population fall between 953 and 1003.
(b) The probability of randomly selecting an observation between 953 and 1003 from the populationis 0.98.
(c) If the true population mean 950, then this sample mean of 978 would be unlikely to occur.
(d) If the true population mean is 990, then this sample mean of 978 would be unexpected.
(e) If the true population mean is 1006, then this confidence itnerval must have been calcluated incorrectly.

10. A survey of 2450 showed that 281 of them are left-handed. Construct a 98% confidence interval for the proportion of golfers that are left-handed.

(a) (0.683, 0.712)   (b) (0.369, 0.451)   (c) (0.203, 0.293)   (d) (0.100, 0.130)

11. A marketing research company is estimating which of two soft drinks college students prefer. A random sample of 157 college students produced the following confidence interval for the proportion of college students who prefer drink A: (.344, .494). Is this a large enough sample for this analysis to work?

(a) Yes, since n = 157 (which is 30 or more).
(b) No.
(c) Yes, since both $n\hat{p} \geq 10$ and $n(1 - \hat{p}) \geq 10$.
(d) It is impossible to say with the given information.

12. What type of car is more popular among college students, American of foreigh? One hundred fifty-nine college students were randomly sampled and each was asked which type of car he or she prefers. A computer package was used to generate the printout below of a 90% confidence interval for the proportion of college students who prefer American automobiles.

SAMPLE PROPORTION = 0.396   SAMPLE SIZE = 159   INTERVAL: (0.332, 0.460)

Based on the interval above, do you believe that 21% of all colleges tudents prefer American autombiles?

(a) No, and we are 90% confident of it.
(b) Yes, and we are 100% sure of it.
(c) No, and we are 100% sure of it.
(d) Yes, and we are 90% confident of it.

13. A random sample of 30 households was selected from a particular neighborhood. The number of cars for each household is shown below. Estimate the mean number of cars per household for the population of households in this neighborhood. Give the 95% confidence interval.

2	0	1	2	3	2	1	0	1	4
1	3	2	0	1	1	2	3	1	2
1	0	0	3	2	2	2	1	0	2

(a) 1 to 2 cars   (b) 1.5 to 1.9 cars   (c) 1.1 to 1.9 cars   (d) 1.3 to 1.7 cars

14. The football coach randomly selected ten players and timed how long each player took to perform a certain drill. The times (in minutes) were:

13.2   5.1   7.5   8.0   12.7   7.6   13.8   14.5   7.7   10.5

Determine a 95 percent confidence interval for the mean time for all players.

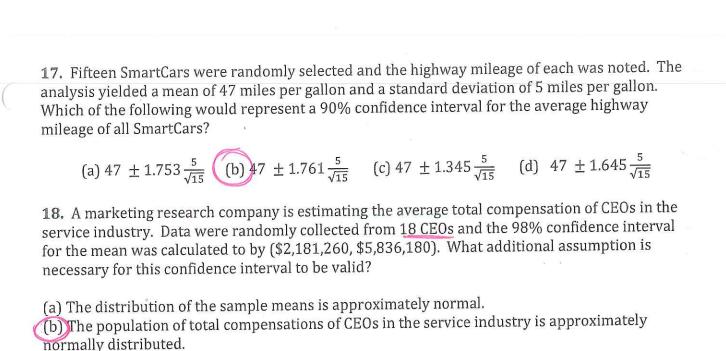(a) $12.30 < \mu < 7.82$ (b) $7.82 < \mu < 12.30$ (c) $7.72 < \mu < 12.40$ (d) $12.40 < \mu < 7.72$

15. Use the given degree of confidence and sample data to construct a confidence interval for the population mean. Assume the population has a normal distribution.

$n = 10, \bar{x} = 9.8, s = 2.4, C = 95\%$

(a) $8.08 < \mu < 11.52$ (b) $8.11 < \mu < 11.49$ (c) $8.09 < \mu < 11.51$ (d) $8.41 < \mu < 11.19$

16. Thirty randomly selected students took the calculus final. If the sample mean was 92 and the standard deviation was 9.4, construct a 99% confidence interval for the mean score of all students.

(a) $89.08 < \mu < 94.92$ (b) $87.27 < \mu < 96.73$ (c) $87.29 < \mu < 96.71$ (d) $87.77 < \mu < 96.23$

17. Fifteen SmartCars were randomly selected and the highway mileage of each was noted. The analysis yielded a mean of 47 miles per gallon and a standard deviation of 5 miles per gallon. Which of the following would represent a 90% confidence interval for the average highway mileage of all SmartCars?

(a) $47 \pm 1.753 \frac{5}{\sqrt{15}}$ (b) $47 \pm 1.761 \frac{5}{\sqrt{15}}$ (c) $47 \pm 1.345 \frac{5}{\sqrt{15}}$ (d) $47 \pm 1.645 \frac{5}{\sqrt{15}}$

18. A marketing research company is estimating the average total compensation of CEOs in the service industry. Data were randomly collected from 18 CEOs and the 98% confidence interval for the mean was calculated to by ($2,181,260, $5,836,180). What additional assumption is necessary for this confidence interval to be valid?

(a) The distribution of the sample means is approximately normal.
(b) The population of total compensations of CEOs in the service industry is approximately normally distributed.
(c) The sample standard deviation is less than the degrees of freedom.
(d) None. The Central Limit Theorem applies.

19. A retired statistician was interested in determining the average cost of a $200,000.00 term life insurance policy for a 60-year-old male non-smoker. He randomly sampled 65 subjects (60-year-old male non-smokers) and constructed the following 95% confidence itherval for the mean cost of the term life insurance: ($850.00, $1050.00). State the appropriate interpretation for this conidence interval. Note that all answers begin with "We are 95% confident that..."

(a) The average term life insurance costs for all 60-year-old male non-smokers falls between $850.00 and $1050.00.
(b) The average term life insurance cost for the sampled 65 subjects falls between $850.00 and $1050.00.
(c) The term life insurance cost of the retired statistician's insurance policy falls between $850.00 and $1050.00.
(d) The term life insurance cost for all 60-year-old male non-smokers' insurance policies falls between $850.00 and $1050.00.

20. Determine the critical value z^* that corresponds to the 88% confidence level.

(a) 1.555   (b) 0.81   (c) 1.21   (d) 1.175

21. Find the critical value t^* that corresponds to a 95% confidence and $n = 16$.

(a) 2.947   (b) 2.131   (c) 2.602   (d) 1.753

22. Find the critical value t^* that corresponds to 90% confidence and $n = 15$.

(a) 2.145   (b) 1.345   (c) 2.624   (d) 1.761

23. A 90% confidence interval for the average salary of all CEOs in the electronics industry was constructed using the results of a random survey of 45 CEOs. The interval was ($139,048, $154,144). Give a practical interpretation of the interval.

(a) We are 90% confident that the mean salary of all CEOs in the electronics industry falls in the interval $139,048 to $154,144.
(b) 90% of all CEOs in the electronics industry have salaries that fall between $139,048 to $154,144.
(c) 90% of the sampled CEOs have salaries that fell in the interval $139,048 to $154,144.
(d) We are 90% confident that mean salary of the sampled CEOs falls in the interval $139,048 to $154,144.

24. Suppose that you wish to obtain a confidence interval for a population mean. Under the conditions described below, should you use the z-interval procedure, the t-interval procedure, or neither?

     -The population standard deviation is unknown.
     -The population is normally distributed. ✓
     -The sample size is small.

(a) z-interval procedure   (b) neither   (c) t-interval procedure

25. Suppose that you wish to obtain a confidence interval for a population mean. Under the conditions described below, should you use the z-interval procedure, the t-interval procedure, or neither?

     -The population is far from being normally distributed.
     -The sample size is large. σ??   bad ?!

(a) z-interval procedure   (b) neither   (c) t-interval procedure

26. You can decrease the width of a confidence interval by:
(a) lowering the confidence level or decreasing the sample size ← wider
(b) lowering the confidence level or increasing the sample size
(c) increasing the confidence level or decreasing the sample size
(d) increasing the confidence level or increasing the sample size

wider